BULLETIN

OF THE INSTITUTE OF METALS

VOLUME 4 DECEMBER 1958 PART 16

INSTITUTE NEWS

Tax Relief on Membership Subscriptions

Under Section 16 of the Finance Act 1958, the subscriptions to certain societies approved by the Inland Revenue are deductible from the emoluments of any employment to be assessed for tax if defrayed out of those emoluments, and if the activities of the society are relevant to the employment. The Institute of Metals has now been approved by the Inland Revenue as a society coming within the terms of this section of the Act.

All members who wish to claim tax relief on their subscription payments should apply to their usual tax office as soon as possible after 31 October 1958 for form P.358 on which to make a claim for adjustment of their P.A.Y.E. coding.

Election of Members

The following 8 Ordinary Members, 1 Junior Member, and 8 Student Members were elected on 23 September 1958:

As Ordinary Members

HOLLYER, John Reginald, Technical Representative and Metallurgist, Fuel Furnaces, Ltd., Shady Lane, Great Barr, Birmingham 22A.

KIRK, Adam Kennedy, Director, Kirk and Co. (Tubes), Ltd., 74/82 Paradise Street, London, S.E.16.

McDONALD, Gavin Grant, M.Sc., Head, Physical Metallurgy Group, Defence Standards Laboratories, Maribyrnong, Vic., Australia.

NIXON, John E. W., Palmer Bee Co., Bloomfield Hills, Mich., U.S.A.

RAY, Robert S., Engineering Inspector-Surveyor, Stone and Webster Engineering, Ltd., 20 Red Lion St., London, W.C.1.

SHRIVASTAVA, Nirmal Chandra, B.Sc., General Manager, P.O. Bhilai Steel Plant, District Durg (M.P.), India.

STAMMERS, Derek Ian, Director and Works Manager, Enfield Rolling Mills (Aluminium), Ltd., Brimsdown, Middlesex.

TYRRELL, Albert Edmund, Deputy Divisional Manager, North Thames Gas Board, Headquarters Division, Vincent St., London, S.W.1.

As Junior Member

LIU PEING WONG, B.Sc., Assistant Engineer, Planning Design Section, Electrical and Mechanical Department, Electricity Supply Board, 197–199 Lower Kemmendine Road, Rangoon, Burma.

As Student Members

BOOKER, Charles James Louis, B.Sc., Ph.D., A.R.I.C., Research Student, Department of Metallurgy, University of Cambridge.

BRANSON, David Leonard William, Laboratory Assistant, Aston Chain and Hook Co., Ltd., Bromford Lane, Erdington, Birmingham 24.

CHAN LIN-TAK, Engineer Apprentice, Scott's Shipbuilding and Engineering Co., Ltd., Greenock.

COLLETT, Mervyn Randall, Laboratory Assistant, Aston Chain and Hook Co., Ltd., Bromford Lane, Erdington, Birmingham 24.

FLOREEN, Stephen, M.S., Graduate Student, Department of Chemical and Metallurgical Engineering, University of Michigan, Ann Arbor, Mich., U.S.A.

KRISHNA, T. L. Sri, B.Sc., Research Student, Department of Metallurgy, Indian Institute of Science, Bangalore 3, India.

STEVENS, Michael John, Trainee Metallurgist, Whitehead Iron and Steel Co., Ltd., Courtybella Works, Newport, Mon.

WILSON, John Richard, B.Sc., M.Met., Research Student, Department of Metallurgy, University of Sheffield.

"Metallurgical Reviews"

Among the subjects on which it is hoped to publish reviews in the next year or so are the following:

Micro-Indentation Hardness Testing.
Direct Experimental Evidence of Dislocations.
The Growth of Metal Single Crystals.
The Theory of Semi-Conductors.
Determination of Residual Stresses.
Friction and Wear.
Techniques of Gas Analysis.
Vacuum Melting.
Combined Continuous Casting and Rolling.
Non-Ferrous Extrusion Practice.
Rod, Bar, and Section Mills.
Joining of Aluminium Alloys.
Techniques of Polarography.
Theories of Sintering.

Metallurgical Reviews is obtainable only by annual subscription. The rates are: members 32*s.* 6*d.* ($5.00) post free and non-members 42*s.* 6*d.* ($6.50) post free.

PERSONAL NOTES

Dr. W. O. Alexander has returned to Imperial Chemical Industries, Ltd., Birmingham, after being seconded for a period to the Company's affiliate in the United States.

Mr. I. Astley has left Cambridge University and is now a metallurgist with Henry Wiggin and Co., Ltd., Birmingham.

Dr. J. L. Aston has joined the Research and Development Department of Head, Wrightson and Co., Ltd., Thornaby-on-Tees.

Mr. C. Brown has left King's College, University of Durham, and is now with C. A. Parsons and Co., Ltd., Newcastle-upon-Tyne.

Mr. G. Campbell has been appointed General Manager of the Chemical and Metallurgical Division of the Plessey Co., Ltd. He was previously Technical Manager and Deputy General Manager of the Company's Towcester plant.

M. M. Dupont has been appointed Directeur Administratif of the *Revue de Métallurgie*.

Professor J. Neill Greenwood, Research Professor of Metallurgy in the University of Melbourne, has been awarded the Silver Medal of the Australian Institute of Metals.

Mr. T. M. Herbert, Director of Research, British Railways, has been elected a Member of Council of the British Welding Research Association.

Mr. P. W. Jackson has left Cambridge University and has joined the staff of the U.K. Atomic Energy Authority at Dounreay, Caithness.

Dr.-Ing. J. Koritta has been appointed Professor of Chemical Technology at the Technical University, Prague.

Mr. E. A. Langham, who has been Resident Representative of The British Aluminium Co., Ltd., in Australia, is returning to England early in 1959.

Mr. A. R. Madsen has left Pyrotenax, Ltd., and is now Assistant Chief Metallurgist/Chief Chemist with Vickers-Armstrong (Tractors), Ltd., Newcastle-upon-Tyne.

Dr. Harold Moore has been elected an Honorary Member of the Iron and Steel Institute.

Dr. J. J. Pick has left the University of Birmingham and is now Physical Metallurgist with Joseph Lucas (Electrical), Ltd., Birmingham.

Mr. N. J. B. Pocock has left Cambridge University and taken up an appointment with Capper Pass and Son, Ltd., North Ferriby, Yorks.

Dr. P. L. Pratt, Lecturer in Physical Metallurgy in the University of Birmingham, has been appointed Reader in Physical Metallurgy at the Imperial College of Science and Technology, London.

Mr. B. R. Price is now Acting Technical Manager, A.M.F. Atomics, Port Hope, Ont.

Mr. D. F. Reardon has left Birmingham University and is now a research assistant at the Battersea College of Technology.

Mr. J. C. Ruckman has been appointed a Senior Scientific Officer with the Atomic Energy Authority, Industrial Group, Dounreay.

Mr. A. Snowman has left the Royal School of Mines and joined the staff of the Solid-State Electronics Research Laboratories, Philco Corp., Pittsburgh, Pa.

Mr. C. J. Snyder has been appointed Chief Metallurgical Engineer, Anaconda Wire and Cable Co., Hastings-on-Hudson, N.Y.

Mr. J. Spreadborough has left the Department of Metallurgy, Oxford, and is now at the Battelle Memorial Institute, Geneva.

Dr. J. W. Suiter has left the Department of Mines and Technical Surveys, Ottawa, and returned to the Baillieu Laboratory, University of Melbourne.

Mr. K. G. Sumner has left Imperial Chemical Industries, Ltd., Metals Division, and joined the U.K. Atomic Energy Authority, Industrial Group, Springfield Works, near Preston.

Mr. J. Waring, Lecturer in Metallurgy at the University of Queensland, is spending one year as a post-graduate student at the Illinois Institute of Technology.

Dr. C. M. Wayman has been appointed Staff Member and Assistant Professor of Metallurgical Engineering in the University of Illinois, Urbana, Ill.

Mr. J. M. Willey, Director and General Manager of Murex Welding Processes, Ltd., has been elected a Member of Council of the British Welding Research Association.

Dr. K. Winterton has been appointed Head of the Welding Section in the Metallurgy Division of the Bureau of Mines, Ottawa.

Deaths

The Editor regrets to announce the death of:

Mr. John Cartland, formerly Director and Works Manager of Fry's Metal Foundries, Ltd., on 28 September.

Professor Dr.-Ing. Herbert Sedlaczek, Head of the Metalworking Department of the Technische Hochschule, Aachen, on 7 October, in Japan, aged 60.

OBITUARY

Professor Carl Benedicks

Professor Carl Benedicks, a man actively engaged in research on metals for more than half a century, died in Stockholm on 16 July, 1958, aged 83.

Carl Axel Fredrik Benedicks came from a family long established in the Swedish iron industry. When quite young he became interested in mineralogy and geology, and particularly in the chemistry and physics of metals. Having presented a Doctor's thesis on carbon steels at Upsala in 1904, he remained as university lecturer in physical chemistry there till 1910, when he became Professor of Physics at Stockholm University. The First World War saw a rapidly growing interest in Sweden in the establishment of a special laboratory devoted to the science of metals. Plans for such a laboratory

were vigorously pushed by Benedicks, who succeeded in winning the support of industry for them. Thanks to his efforts, the Metallografiska Institutet came into being in 1920. It was conceived as a separate laboratory, located in Stockholm and closely linked both to the University and to the Swedish Ironmasters' Association (Jernkontoret). Benedicks planned the building and equipment, and he served as the Director of the Institute during its first 15 years. Relieved from the growing burden of administrative work, he then continued, for more than two decades, his ceaseless enquiry into metal problems, in an adjoining smaller laboratory of his own.

Benedicks's published work covers a wide range of subjects. In the field of metallurgy there are few problems in which he did not take an interest at one time or another. Mention should be made of his efforts to isolate and determine slag inclusions, of the early work on graphite in cast iron and on carbide constituents in steels, and of the development of methods to measure accurately the density of molten metals. He also made contributions in the field of corrosion and passivity. For his detailed study of the quenching action of liquid coolants he was awarded the Carnegie Gold Medal of the Iron and Steel Institute in 1908. Already at the turn of the century he had been working on the electrical conductivity of metals. This and the related field of thermoelectricity never ceased to hold a strong fascination for Benedicks; it suggested itself as the subject for the 10th May Lecture, which he was invited to deliver to the Institute of Metals in 1920. In later years he engaged in work on the changes in tensile strength that result when metallic test specimens are brought into contact with various liquids; in this connection he coined the terms " wetting effect " and " liquostriction ".

Benedicks was a gifted experimenter and was very clever with his hands; he performed intricate operations, produced and used delicate instruments of his own design, and it was a delight to watch him in the tool shop or glass blowing. His natural inclination toward practical things and experiments was evident also in his theoretical work, which often displayed a wealth of ideas, with a preference for simple and tangible models and concepts. Throughout his life Benedicks was, in fact, possessed by the urge to understand nature in simple terms—to an extent which occasionally made him cling to views which a critical mind would feel forced to reject, particularly in the field of pure theory.

With his vivid imagination was mingled an artistic strand. His deft hands, aided by a keen eye, produced several good portrait sketches, sometimes caught on the spur of the moment, when listening to a speaker at a meeting. Indeed, some of these now remain as the bright nugget in the pan of an otherwise dull lecture.

Carl Benedicks received many honours both at home and abroad. Among these he treasured particularly the Prix Henry Wild in 1922, the Bessemer Medal in 1927, and election as Honorary Vice-President of the Iron and Steel Institute in 1922 and as Honorary Member of the Institute of Metals in 1937. He maintained wide international contacts and was for many years frequently seen at scientific meetings in other countries, where he had many good friends. He spoke several languages and was fearless in debate. Kind of heart, he cultivated friendship. He loved to engage in a spirited conversation at any time, and he regretted that failing health in the last few years forced him to restrict his activities in this respect.

He joined the Institute in 1911 and was for many years Corresponding Member to the Council for Sweden.

E. RUDBERG.

LETTER TO THE EDITOR

Compatibility of Niobium with Bismuth

During the past few years a number of papers [1,2] have been published in which materials suitable for use in contact with liquid metals are reviewed. Amongst these niobium has been listed as being a satisfactory container material for bismuth at temperatures of 600° C. and above. Since no experimental evidence has been put forward to support these claims, it was decided to conduct a series of simple tests to determine the solubility of niobium in bismuth at 600° C. and its compatibility at 1000° C. The niobium used in these tests was in the form of sheet material 0·010 in. thick, supplied by Murex Ltd., and had the following analysis: Fe 0·01–0·02%, Cr trace, Ni trace, C 0·01%, Ta 0·1%, O_2 0·01%.

For the solubility tests four pieces of niobium sheet approximately 5 × 0·5 cm. were sealed into evacuated Pyrex capsules together with a standard amount of bismuth. The bismuth loaded in two of the capsules was taken from vacuum-melted and filtered stock of 99·95% purity, whilst that used in the remaining capsules contained approximately 2000 p.p.m. magnesium. The magnesium addition was made in an attempt to remove residual oxygen from the bismuth. The capsules were placed in a furnace maintained at 600° ± 3° C. and removed after 150 hr. for chemical analysis and metallographic examination. Metallographic examination showed no attack on the niobium which had been in contact with the pure bismuth. In one of the samples containing magnesium, a vacuum leak had occurred and the niobium was pitted at several points. The analytical results are presented below:

		Nb, p.p.m.
Capsule 1:	Bi–Mg (oxygen leak)	150
Capsule 2:	Bi–Mg	100
Capsule 3:	99·95% bismuth	200
Capsule 4:	99·95% bismuth	180

These results indicate that although niobium does not suffer from intergranular attack under nominally static short-term tests in bismuth at 600° C., it has a significant solubility.

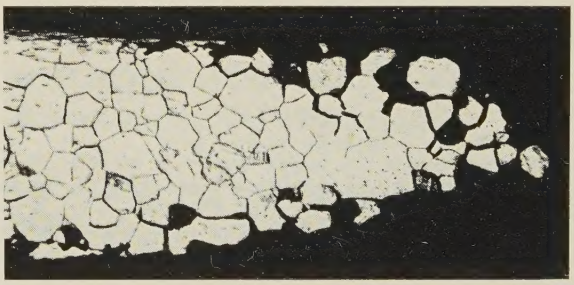

FIG. 1.—Intergranular attack of niobium by bismuth at 1000° C. Etched in HNO_3–HF. × 150.

Since this work began, a figure for the solubility of niobium in bismuth at 600° C. of 110 p.p.m. has been reported.[3]

The higher figures in this investigation may be due to the presence of traces of oxygen in the bismuth. This hypothesis receives some support when the chemical-analysis figures obtained for niobium in magnesium and bismuth are considered. Thus, in the capsule which did not suffer a vacuum leak, the niobium was present to the extent of 100 p.p.m., whereas a value of 150 p.p.m. was obtained when oxygen leaked into the system.

In the tests at 1000° C. a similar technique was employed, but silica glass capsules were used instead of Pyrex. After 170 hr. in bismuth, the contents of the capsule were examined, and it was found that the niobium had suffered from marked intergranular attack by the bismuth (Fig. 1). Examination of the surrounding bismuth revealed large segregates of

FIG. 2.—Segregation of niobium dendrites near surface of bismuth. Unetched. ×40.

niobium dendrites (Fig. 2). These results are substantiated by the fact that experiments carried out in the U.S.A.[4] showed that pronounced attack of niobium took place in bismuth of unspecified purity at 980° C.

The results of these investigations indicate that niobium is not a suitable material for the containment of liquid bismuth even under oxygen-free conditions, i.e. in bismuth containing magnesium. Indeed, in non-isothermal systems operating below 600° C., niobium loops would probably suffer from more serious mass-transfer effects than systems constructed from low-alloy steels.[3]

G. W. PARRY.
L. W. GRAHAM.

Hawker Siddeley Nuclear Power Co., Ltd., Langley, Slough, Bucks.

REFERENCES

1. A. B. McIntosh, *J. Inst. Metals*, 1956–57, **85**, 367.
2. C. R. Tottle, *Nuclear Eng.*, 1958, **3**, 212.
3. B. R. T. Frost *et al.*, *2nd United Nations International Conference on Peaceful Uses of Atomic Energy* (1958), Paper **270**, p. 26.
4. O. Parkman and R. Sheperd, *U.S. Atomic Energy Commission Publ.*, **(ORO-5)**.

OTHER NEWS

Conference on Fracture

The National Academy of Sciences–National Research Council has announced that a Seminar on the Atomic Mechanisms of Fracture will be held in Cambridge, Massachusetts, on 12–14 April, 1959. Open to interested technical persons, this Conference will feature invited papers from the U.S. and abroad on the following topics: (*a*) theoretical aspects of fracture, (*b*) cleavage, (*c*) crystalline and non-crystalline fracture, (*d*) fatigue and ductile fracture, and (*e*) high-temperature fracture.

The Conference is being sponsored jointly by the National Science Foundation, Office of Naval Research, Air Force Office of Scientific Research, and the National Academy of Sciences–National Research Council. Further information will be available from Dr. B. L. Averbach, Chairman, or Dr. D. K. Felbeck, Secretary, Conference on Fracture, National Academy of Sciences–National Research Council, Washington, D.C.

"The Cast Structure in Metal Founding"

A short course dealing with the theoretical and practical aspects of structure in castings will be held in the Department of Industrial Metallurgy, University of Birmingham, from Monday 15 December, to Wednesday 17 December 1958.

The attendance fee for the course is £2 2*s.* 0*d.*

Further particulars on application to the Secretary, Department of Industrial Metallurgy, The University, Birmingham 15.

Postgraduate Education in Aircraft Materials

A Department of Aircraft Materials has now been established at The College of Aeronautics, Cranfield, so that in the future students may elect to take this subject as their main specialization in the postgraduate College Diploma course. This new specialization will embrace engineering techniques in applications of materials as well as the basic relevant sciences, particularly physical metallurgy and solid-state physics. It will cover both metals and non-metallic materials, and will deal especially with those branches which are of particular aeronautical concern, such as high-temperature behaviour, dynamic stressing, and fabrication. Research forms an essential part of the activity of the Department, and several investigations are now in progress, mainly in the fields of creep and fatigue. Students for the new specialization will co-operate in such researches as part of their thesis work.

In establishing this new activity within the framework of the present College Diploma, it is recognized that the Department can also offer Courses outside the Diploma syllabus of interest to all the industries concerned with the mechanical, electrical, or magnetic properties of materials.

It is therefore intended to set up a short course on materials, of about two months' duration, which will be open to industry generally. The aim of such a course is to present to those concerned with engineering applications of materials a working knowledge of modern developments in materials theory and technology. Those interested in an advanced course of this kind are invited to write to Professor A. J. Kennedy, The College of Aeronautics, Cranfield, Bletchley, Bucks, so that some assessment of the potential demand may be made.

The Physical Society Exhibition

The Physical Society Exhibition of Scientific Instruments and Apparatus will be held at the Royal Horticultural Society's Old and New Halls, Westminster, London, S.W.1 (just behind Victoria Street from Artillery Row) on the following dates:

Monday, 19 January, 10.30 a.m. to 7 p.m. (Members and Press only, 10.30 a.m. to 2 p.m.).
Tuesday, 20 January. 10 a.m. to 9 p.m.
Wednesday, 21 January. 10 a.m. to 7 p.m.
Thursday, 22 January. 10 a.m. to 4.30 p.m.

FOUR IMPORTANT METALS BOOKS

from the American Society for Metals

CREEP AND RECOVERY

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"The utmost in metalworking precision is found in the 'heart' of a jet engine. Disks, mounted on the compressor, must withstand tremendous stresses created by fantastically high temperatures. An error in the amount of heat expansion to expect can turn a jet engine into a disfigured mass of molten metal."

Creep and Recovery deals authoritatively with this interesting and fascinating aspect of metals—changes in dimension under stress and removal of residual stress. Metallurgists, Engineers, Designers, solid state Physicists, and Chemists will find this assembly of the most recent experiments and thoughts on recovery and creep to be invaluable. These masterful papers, extremely well-supplemented with graphs, tables, charts, and photomicrographs, speak with authority and conviction in fourteen different areas of the subject matter. All the knowledge and experience of twenty-two authorities is brought to you in this easily-read, hard-bound edition—a bound volume of papers presented at the meeting on "Creep and Recovery" in Cleveland, Ohio, 1956.

"The Concept of Creep", "The Theory of Creep", "Recovery of Mechanical Properties", and "Creep and Rupture" are only a few of the papers expertly offered in this beautifully bound 6¼ × 9¼, 372 page book. Never will you find more current material on recovery and creep. Never will you profit more by the experience of such outstanding authors. Act now! Fill in the coupon below. You'll be glad you did!

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DUCTILE CHROMIUM

If you produce, extract, test, fabricate, design, or use metals in any way, this report of 49 experts on chromium can give you the most up-to-date and accurate information available today. Entirely new fields of usefulness for chromium and its alloys are forecast in this well-illustrated volume of proceedings at the important conference on Ductile Chromium co-sponsored by the Office of Ordnance Research, U.S. Army, and the American Society for Metals.

More than twenty years of intensive research in the United States, Europe and Australia have been devoted to the development of chromium-base alloys for high temperature service. Learn of the significant work on the extraction, fabrication and properties of a metal that is a most promising base for new alloys of superior oxidation resistance and strength at elevated temperatures.

The book's 27 chapters are presented in five sections. Section 1 provides a general review of research on chromium. Section 2 deals with the production of chromium metal. Section 3 discusses ductile chromium metals, with Section 4 devoted to the effect of gas on chromium metal, and Section 5 reports on high-chromium alloys.

Here is an opportunity for you to explore the many new applications for chromium. Be an authority on ductile chromium—over one million tons of chromite ore are consumed annually in the United States! Take advantage of this chance to learn what 49 authorities know about this increasingly important metal. Send for Ductile Chromium with the coupon below.

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EFFECT OF RESIDUAL ELEMENTS

Learn the importance of impurities in metals! Strangely enough, as this new authoritative book explains, if absolutely pure metals could and were to be substituted for the technical grades currently in use, the metal fabrication industries would be faced with many new and difficult problems! Learn how "Trace Elements" strangely influence mechanical properties and crystal growth of metals. Learn how these impurities influence the strength and ductility of metals!

In this review of fundamental considerations of residual elements, the authors expertly write of the effects these elements have on aluminum, magnesium, copper, nickel, steel, titanium, zirconium, molybdenum, and chromium. Learn how these metals are affected by residual elements. Learn how residual elements, produce favorable qualities and, just as frequently, adverse qualities! Attractively bound in red cloth and consisting of 217 pages, this book brings to you the up-to-date reports of five authorities. Easy to read and well-supplemented with charts, graphs, tables, and photographs, it will become a ready reference for designers, engineers, metallurgists and others whose job it is to know metals.

Make the knowledge of these experts *your* knowledge. Give yourself the advantage of being well-read on metals. Be capable of answering questions that before were only asked of others. Send today for *Effect of Residual Elements on the Properties of Metals.*

$4.00

FATIGUE DURABILITY OF CARBURIZED STEEL

What factors determine fatigue durability in carburized steel? Why do some carburized steels withstand more stress than others? You can find out in this just-off-the-press book *Fatigue Durability of Carburized Steel.*

Five authorities establish as their goal a better understanding of the interrelation of factors that determine fatigue durability. They state their goal clearly, describe the research and testing accomplished and finish with a declaration of definite conclusions. This is the story of a question and an elusive, but finally captured, answer.

The book is divided into five sections to enable thorough coverage of the subject matter. Beginning with a review of prior efforts, dating as far back as 1860, the authors smoothly and capably document each phase of the search for a better understanding of factors influencing fatigue durability.

For men who specify, design, produce, or use components of carburized steel, *Fatigue Durability of Carburized Steel* gives valuable information and numerous enlightenments that will aid in determining the most effective applications. As a reference, you will reach for it again and again. Help yourself to a more comprehensive understanding of *Fatigue Durability of Carburized Steel.* Read this up-to-the-minute account of fatigue durability that will give you sound reasons for selecting or using particular grades of carburized steel. Increase your sphere of influence and general knowledge of metals by sending in the coupon below.

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As in past years, the Exhibition will remain open during the lunch hour.

The Handbook published in connection with the Exhibition will be available in mid-December and may be obtained from the Physical Society, 1 Lowther Gardens, Prince Consort Road, London, S.W.7. The price to non-members of the Society is 6*s.*; by post 7*s.* 8*d.*

Essays on Corrosion Science

The Education Panel of the Corrosion Group of the Society of Chemical Industry has again decided to offer a prize of 25 guineas for an essay on corrosion science by a young author.

Essays are accordingly invited from persons who will not be more than 27 years of age on the closing date, 31 March 1959. A length of about 4000 words is suggested, but reasonable latitude will be allowed.

Further details may be obtained from the Society of Chemical Industry, 14 Belgrave Square, London, S.W.1.

DIARY

Local Sections and Associated Societies

6 January. East Midlands Metallurgical Society. "Royal Crown Derby China", by C. F. Osborn. (Electricity Demonstration Theatre, Carrington Street, Nottingham, at 7.30 p.m.)

6 January. Oxford Local Section. "The Training of Metallurgists", by Professor J. G. Ball, Professor W. S. Owen, and Dr. B. R. Coles. (Cadena Café, Cornmarket Street, Oxford, at 7.0 p.m.)

8 January. Birmingham Local Section. "Metallurgical Education in the U.S.S.R.", by Dr. I. G. Slater. (College of Technology, Gosta Green, Birmingham 4, at 7.0 p.m.)

8 January. Liverpool Metallurgical Society. Student Prize Competition. (Joint Meeting with the University of Liverpool Metallurgical Society.) (Library of the Department of Metallurgy of the University of Liverpool, 146, Brownlow Hill, Liverpool 3, at 7.0 p.m.)

8 January. London Local Section. "Electron Probe Micro-Analysis", by T. Mulvey. (Joint Meeting with the Society of Chemical Industry.) (17 Belgrave Square, S.W.1, at 6.30 p.m.)

13 January. South Wales Local Section. "The Zinc Blast Furnace", by S. W. K. Morgan. Royal Institution, Swansea, at 6.30 p.m.)

15 January. Leeds Metallurgical Society. "The Ultimate Structure", by T. J. Parry and S. Newton. (Lecture Room C, Chemistry Wing, The University, Leeds 2, at 7.15 p.m.)

15 January. Southampton Metallurgical Society. Members' Night. Three short papers by members (Small Physics Lecture Theatre, The University, Southampton, at 7.15 p.m.)

21 January. Manchester Metallurgical Society. "The Investigation of Metallurgical Failures in Aircraft", by D. A. Ryder. (Manchester Room of The Central Library, Manchester, at 6.30 p.m.)

22 January. Birmingham Local Section. "Mechanism of Solidification in Cast Iron", by H. Morrogh. (Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham 2, at 7.0 p.m.)

22 January. Sheffield Local Section. Research Topics. (Engineering Lecture Theatre, The University, St. George's Square, Sheffield 1, at 7.30 p.m.)

27 January. North East Metallurgical Society. "Some Characteristics of High-Strength Aluminium Alloys", by G. Goddard. (Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough, at 7.15 p.m.)

British Nuclear Energy Conference

22–23 January. Symposium on "Nuclear Fuel Cycles", sponsored by the Institute of Physics.

APPOINTMENTS VACANT

SIEMENS EDISON SWAN RESEARCH LABORATORY

PHYSICAL METALLURGIST

required to apply metallurgical principles to the study of solid-state devices, including transistors. A good theoretical background is essential and preferably a working knowledge of phase equilibrium diagrams. The successful candidate will be offered a competitive salary and ideal working conditions in a new, well-equipped research laboratory. Rented housing is available if required. Please write for further information to:

Personnel Officer,
Siemens Edison Swan Research Laboratory,
West Road, Temple Fields,
Harlow, Essex.

THE UNIVERSITY OF MINNESOTA
Department of Metallurgy

Applications are invited for the position of PROFESSOR OF METALLURGY in the field of chemical metallurgy. This professorship will be responsible for developing both undergraduate and graduate courses in extractive metallurgy where emphasis will be placed on the thermodynamics and kinetics of slag–metal, gas–metal reactions, and the thermodynamics and properties of liquid–metal systems. The recipient will have ample opportunity and support to develop a fundamental research programme in these fields. The department is seeking a man for a senior staff position. The salary for the position will be up to $12,000 per academic year, depending upon the candidate's qualifications.

Applications should be submitted as soon as possible to the Head, Department of Metallurgy, University of Minnesota, Minneapolis 14, Minnesota, U.S.A. Further particulars may be obtained from the Metallurgy Department.

LOUGHBOROUGH COLLEGE OF TECHNOLOGY

Applications are invited for two posts in the Department of Industrial Engineering:

(a) *Reader in Engineering Production Technology*
Salary scale £1550 × £50–£1800 per annum.

(b) *Lecturer in Industrial Metallurgy*
Salary scale £1200 × £30–£1350 per annum.

(*a*) Applicants for the position of Reader should possess high academic qualifications and have had wide industrial experience, preferably including research experience in the field of primary forming processes, metal cutting, machine tools, or metrology. He will be required to initiate, conduct, and supervise research projects, and to co-ordinate staff activities in his general field. He will undertake some lecture work.

(*b*) Applicants for the position of Lecturer should possess good academic qualifications in Industrial Metallurgy and have had industrial and teaching experience in the primary forming processes, including plastic and molten processes, refractories and welding. He will undertake teaching in Diploma of Technology courses.

Both posts are pensionable, and commencing salaries will be determined by previous experience and qualifications. Application forms and further particulars may be obtained from the Registrar. (In reply please quote 28/AK.)